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INTRODUCTION TO EXECUTIVE FUNCTION IN PRESCHOOL-AGE CHILDREN

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If one were to gather 100 researchers, policymakers, and practitioners and ask them to rate the importance of the development of executive function (EF) skills in preschool-age children, it is likely that most, if not all, would place a high importance on such an outcome. If one were to ask the same 100 to define *executive function*, at least 100 different definitions would likely be given. Such is the state of the field—there is general agreement regarding the importance of EF in early childhood and later adolescence but little consensus on the definition and components of EF. The purpose of this volume is not to provide a consensus based on evidence from these areas. Rather, it is to reflect the current state of knowledge regarding EF measurement, neurodevelopment, and translational research. Indeed, premature consensus at this point would likely do more

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harm than good, as it would stifle innovation and make it more difficult to study all aspects of this complex construct.

DEFINING EXECUTIVE FUNCTION

EF in young children can generally be described as comprising a number of cognitive processes that, over time, support children's ability to increasingly regulate their own behavior and, in turn, develop greater social, emotional, and cognitive competence. These cognitive processes are thought to include working memory (the ability to pay attention and remember facts while using them to complete tasks), inhibitory control (the ability to follow rules, modulate emotions, and delay gratification), and cognitive flexibility (the ability to plan, make judgments, and self-correct). The development of EF skills and abilities is fundamental to learning because they lay the foundation for adaptive, goal-directed behaviors that enable the child to override more automatic (e.g., cry, scream, run away) or impulsive (e.g., grab for or throw objects) thoughts and responses. It is crucial for young children to acquire these skills in order to be ready to learn when they begin school and to have continued academic success.

Longitudinal frameworks are critical not only to measurement but also to theories and conceptualization of EF. There have been difficulties in specifying developmental trajectories for EF, partly related to questions about whether EF is one skill or a set of skills, and partly because the age range for development is so broad. Currently, it is difficult to compare results across research findings because there is no guarantee that investigators took similar approaches to their conceptualization and measurement of EF. It is likely that developmental trajectories differ for various EF components (e.g., working memory, inhibition) and that these differences are crucial to an examination of how these components interact to support or develop more complex learning and cognitive functioning. In addition, the potential for identifying sensitive periods to guide the timing and design of interventions should emerge from studies of the trajectory of EF from early childhood to adolescence (and beyond).

OVERVIEW OF THE VOLUME

This volume was inspired by a workshop[1] and subsequent discussions of the definition, conceptualization, and measurement of EF in the preschool period. The workshop and later discussions were held with scientists from

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diverse fields, including developmental psychology, cognitive neuroscience, early education, and applied/clinical psychology. This volume is the result of the ideas, theories, research, and insights from these scientists and, it is hoped, may move the field toward an interdisciplinary, multilevel analytic approach to conducting EF research with preschool-age children.

For this volume, authors were charged with reviewing the current state of the research on EF competence in preschoolers, considering how best to define the construct of EF, and proposing promising areas of research ripe for advancement and translation. Recent research suggests that early EF skill development provides the critical foundation for school readiness and self-regulation. However, as has been mentioned, there has been no consistent definition or conceptualization of EF competence in the earliest years. Nor has there been agreement on how best to measure the construct or its components in the preschool period. This volume, therefore, addresses these areas and their translational implications, such as novel interventions to improve EF skills in young children from risk groups or disadvantaged backgrounds, and builds the beginnings of an agenda for future basic and translational research in EF development in the preschool period. Specifically, the volume has three overarching goals: (a) to increase the inclusion of detailed information regarding the conceptualization and measurement of EF skills in basic and translational research studies to ensure comparability; (b) to review what is known about the developmental trajectory of EF in preschoolers, including the neurobiological mechanisms and neurocircuitry underlying the development of EF and the role of EF in risk and resilience; and (c) to highlight translational implications leading to novel interventions designed to improve or enhance early EF skill development.

ORGANIZATION OF THE VOLUME

The volume contains three major parts. Part I deals with conceptualization and measurement of EF in the preschool period, tackling the thorny issues of how researchers conceptualize EF at these early stages of development, measure the skills considered components or aspects of EF, and address measurement continuity across ages—an issue especially problematic for research comparing performance of groups of children at different ages or investigating performance in the same children longitudinally. This part begins with a chapter by Diamond, who addresses the many varying definitions of EF. This

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is followed by a chapter by Carlson, Faja, and Beck, who examine various challenges and opportunities regarding the definition and measurement of EF. Nelson, James, Chevalier, Clark, and Espy then highlight the developmental course of EF, reviewing the evidence supporting different latent construct models of EF across the lifespan. Building on these models of EF, Willoughby and Blair summarize their work developing and evaluating the psychometric properties of a battery of tasks to assess EF during early childhood. At the end of this part, Eisenberg and Zhou explore the intersection between EF and self-regulation, thus setting the stage for discussions (in subsequent parts and chapters) of the extent to which EF subserves or overlaps with other aspects of cognitive development.

Part II addresses neurodevelopment—psychobiological issues and neural pathways of EF skills from infancy into toddlerhood and beyond. First, Rose, Feldman, and Jankowski propose a developmental cascade model that links deficits in information-processing abilities among infants born prematurely to similar deficits during toddlerhood. The next chapter, by Bell and Cuevas, describes the changes in neural activity and frontal synchrony associated with development of EF skills and the ways in which two particular constructs—child temperament and parenting characteristics—contribute to individual differences in EF development. Horowitz-Kraus, Holland, and Freund then provide an overview of how advances in neuroimaging and electrophysiological techniques can be applied to the study of EF development. Fisher and Kloos conclude this part by describing extant research on the orienting and executive systems of selective sustained attention, paying particular attention to their measurement, developmental course, neural substrates, and relevance to EF.

In the final part, Part III, the chapter authors address translational research to examine risk and resilience as they pertain to EF, beginning with McClelland, Leve, and Pears, who focus on the negative effects of early risk on the development of EF, but also note that strong EF skills may buffer against the poor academic and social outcomes often associated with early environmental, genetic, or familial adversity. Lawson, Hook, Hackman, and Farah then provide an overview of the influence of socioeconomic status on EF. Next, Caughy, Owen, and DeLuna describe their experiences assessing EF among low-income, ethnic minority preschoolers and the striking disparities in EF skills within this population. Bierman and Torres provide an overview of the multiple early education and intervention programs designed to promote the development of executive function, ranging from individualized training of working memory and attentional control to school-based programs that foster social–emotional learning, sociodramatic play, and positive classroom climates. In the final chapter of the volume, Morrison and Grammer attempt to make sense of the conceptual clutter

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summarized in the preceding chapters, to advance several proposals to move the field forward, and to suggest areas that must be addressed in early childhood EF research. And that is our hope for this volume—that it will encourage researchers to clearly define and operationalize their conceptualization and measurement of EF and engage in rigorous, replicable basic and translational research that concomitantly increases the field's understanding of the neurobiological and behavioral mechanisms at work in EF and informs the development and testing of new interventions that can meaningfully enhance the development of EF skills in early childhood and throughout the lifespan.